

REMARKS/ARGUMENTS

In view of the following remarks reconsideration of the pending claims is respectfully requested.

Claims 1 – 48 have been rejected under 35 U.S.C. § 103(a) as being obvious over Heikkila in combination with newly cited U.S. Patent No. 3,988,198 to Wilson et al.

The primary reference, Heikkila, is directed to a process for the preparation of xylose from a paper-grade hardwood pulp which includes treating the pulp with a xylanase enzyme treatment. See Abstract. Heikkila repeatedly emphasizes that the process is directed to extraction of xylose from paper-grade pulp. See for example, Abstract; Column 1, line 8 – 12; column 5, lines 14 – 16; Examples 1 – 21 and the Claims. After xylanase treatment and removal of the xylan, the resulting pulp could then be used as a dissolving pulp. See column 5, lines 43 – 49.

Wilson is directed to a process for recovering and reutilizing pulping chemicals from waste effluents produced during the manufacture of dissolving grade pulps. See column 1, lines 9 – 12. Wilson has absolutely no relation to a process for the production of xylose. Wilson teaches that heat treatment of spent effluent renders the “effluents suitable for use in cooking, bleaching, and refining of dissolving pulps without adverse effect on the quality of the pulps.” See column 2, lines 23 – 28. According to the teachings of Wilson, heat treatment of the spent effluent stream causes thermal degradation of the hemicelluloses that are dissolved in the spent effluent “so that hemicelluloses will no longer precipitate out on cellulosic materials or otherwise interfere with the action of the caustic soda when the effluents are utilized for treating cellulosic material.” See column 2, lines 66 – column 3, line 1. As a result, the spent effluent streams can be reused in further processes and in particular in caustic extractions.

As a preliminary matter, it should be pointed out that a pre-hydrolyzed cellulose pulp is a dissolving-grade pulp. In this regard, Applicants have provided an excerpt from Gary A. Smook, HANDBOOK FOR PULP & PAPER TECHNOLOGIST, 2d, page 79 (1999) (hereinafter (“Smook”), that discusses that the prehydrolysis step is used to make a dissolving-grade pulp. Further, the excerpt from Ingruber et al, Editor, Vol. 4 Sulfite SCIENCE & TECHNOLOGY, PULP AND PAPER MANUFACTURE, 3d ed., pg. 233 (hereinafter “Ingruber”), which was previously provided to the

Examiner by the Applicants, further supports the conclusion that a prehydrolyzed pulp is a dissolving grade-pulp. Thus, the prehdryolyzed pulp described in Wilson is a dissolving-grade pulp, which is consistent with the Wilson's use of the term. See for example, column 1, lines 9 – 12.

The Examiner contends that it would have been obvious to use Wilson's dissolving-grade pulp in the process of Heikkila. Applicant submits however that the Examiner has failed to establish a *prima facie* case of obviousness. First, there is nothing in the references themselves which would motivate one of ordinary skill in the art to use the dissolving-grade pulp of Wilson in the production of xylose, let alone in the process of Heikkila. Second, Heikkila includes numerous statements that teach away from using a dissolving-grade pulp, and therefore one of ordinary skill in the art would not be motivated to combine Wilson with Heikkila.

A. There is no motivation for combining Wilson and Heikkila

There are no teachings in either Wilson or Heikkila that suggest the desirability for using a dissolving-grade pulp in place of the paper-grade pulp of Heikkila. As noted above, Heikkila is directed to a process of producing xylose using a paper grade-pulp. In contrast, Wilson is directed to a process of heat treating a spent effluent stream so that the effluent stream can be reused in a process for extracting a dissolving-grade pulp. The processes of Wilson and Heikkila are directed to two completely unrelated objectives and there are no teachings in either reference that would motivate one of ordinary skill in the art to look at a process for preparing a dissolving-grade pulp for guidance in recovering xylose.

Further, dissolving-grade pulps and paper-grade pulps have different chemical structures, different properties, different end uses, and are extracted using different processes. This distinction is well known in the art and is noted in Smook, Ingruber, as well as in Heikkila itself. For example the background of Heikkila states:

Hardwood pulp produced by the kraft process contains a significant amount of hemicelluloses, chiefly xylans. The xylans, in moderate amounts, are desirable in paper manufacture because they help maintain a random dispersion of fiber in the furnish, resulting in more uniform and mechanically stronger paper webs.

However, when pulp is used in the production of cellulose esters and other

cellulose derivatives, the pulp normally must contain a very low level of xylan. Hardwood kraft pulp for paper manufacture generally contains about 80 to 84% cellulose, about 15 to 20% xylans, and about 0.3-3% mannans. In contrast, dissolving-grade pulp suitable for cellulose ester manufacture for fiber and film applications should contain about 97 to 98.5 weight percent cellulose, not more than about 3 weight percent, e.g., 0.5 to 3 weight percent, xylans, and not more than about 0.5 weight percent, e.g., 0.1 to 0.5 weight percent, mannans. This requirement for higher purity necessitates more drastic treatment with alkali, with resulting decrease in pulp yield. Since the hemicelluloses removed normally are not recovered from such treatments, they are used, if at all, as fuel and have negligible value.

See column 2, lines 54 –column 2, line 7. Thus, given the significant distinctions between paper-grade pulps and dissolving-grade pulps, there are no teachings in the references or in the general knowledge of one of ordinary skill in the art that would motivate one to substitute the paper-grade pulp with a dissolving-grade pulp.

In combining the references, the Office Action states that it would have been obvious to one of ordinary skill in the art to substitute the pulp used in the process for the production of xylose from hardwood pulp of the Heikkila patent with the prehydrolyzed pulp of Wilson in view of the recognition in the art, as evidenced by Wilson, ““that heat treatment of hemicaustic effluent allows gradual lowering of the extraction concentration from 9.5% NaOH to 9.1% NaOH, without adverse effect on caustic solubility and hemicellulose content of the extracted pulp and with only minor reduction of brightness.”” See Office Action dated January 12, 2007 (quoting Wilson column 9, lines 11 – 16). It is not clear how this statement provides motivation for using a dissolving-grade pulp in the process of Heikkila since neither the claimed invention nor Heikkila discuss heat treatment of a spent effluent stream, let alone, using the heat treated spent effluent stream in the process. Perhaps, the Examiner has mistakenly interpreted this excerpt to somehow mean that the dissolving-grade pulp described in Wilson can be extracted at a lower NaOH concentration. If this is the case, this excerpt has been misinterpreted. This excerpt is discussing the merits of heat treating the spent effluent, such as lowering of NaOH

concentration in the treated spent effluent in comparison to non-treated spent effluent; it is not discussing the merits of dissolving-grade pulp or pulp that is extracted using the spent heat treated effluent. At best it states that the pulp extracted with the heat treated effluent did not adversely affect the hemicellulose content of the extracted pulp. In other words, heat treating the spent effluent allows the concentration of NaOH in the treated effluent to be lowered because the amount of hemicellulose in the effluent is reduced due to thermal degradation. Thus, the excerpt cited by the Examiner provides no motivation that would lead one of ordinary skill in the art to substitute the paper-grade pulp of Heikkila with a dissolving-grade pulp. This is particularly true given the numerous statements in Heikkila that teach away from the use of a dissolving-grade pulp as a source of xylan/xylose as explained in more detail below.

The Office Action further states that “one of ordinary skill in the art would have been motivated to combine the teachings of Heikkila and Wilson in order to reject the instant claims under 35 U.S.C. § 103 since both documents disclose the treatment of pulp materials for industrial applications.” See Office Action, page 4. This is not the correct legal standard for establishing motivation to combine references. Rather, as discussed above, the motivation must come from the references themselves or in the knowledge generally available to one of ordinary skill in the art. See MPEP 2143. If the standard offered in the Office Action were correct, no claims would withstand an obviousness rejection because an Examiner would always be motivated to combine references in the interest of making a rejection.

B. Heikkila teaches away from the use of a dissolving-grade pulp

Heikkila includes numerous statements that teach away from the use of dissolving-grade pulps, such as prehydrolyzed pulp, as a source of xylan/xylose. For example, Heikkila states at column 3, lines 3 – 7 that [t]he additional purification, which involves treatment with alkali to remove and destroy hemicelluloses and bleaching to remove and destroy lignin reduces the yield and increases the cost of "dissolving-grade" cellulose derived from wood pulp”, and at column 3, lines 3 – 7, Heikkila describes that the processes used in preparing dissolving-grade pulps would result in decreased yields of pulp. Heikkila further states “[t]he low molecular weight of some of the hemicellulose fragments makes them hard to isolate, while in some cases (prehydrolysis kraft), the harsh conditions convert the hemicelluloses to decomposition products.” See column

2, lines 41 – 44 (emphasis added). From these excerpts it can be clearly seen that Heikkila includes numerous statements that lead away from using a dissolving-grade pulp (i.e., a prehydrolyzed pulp) because the processes involved in the prehydrolysis process results in decomposition of the hemicellulose components, such as xylan. Thus, one of ordinary skill in the art would not be motivated to use a prehydrolyzed pulp in the process of Heikkila, let alone in a process for producing a xylose.

Further, Example 21 of Heikkila compares xylose recovery using a paper-grade pulp to xylose recovery using a dissolving-grade pulp. In Example 21, both the paper-grade pulp and the dissolving-grade pulp were subjected to a xylanase treatment. From Table X it can be seen that the amount of xylan removed from the dissolving-grade pulp was only 8 to 16% of that extracted from paper-grade pulp. Thus, the use of a dissolving-grade pulp resulted in significant less recovery than the paper-grade pulp. This further supports the conclusion that one of ordinary skill in the art would not be motivated to substitute a paper-grade pulp with a dissolving-grade pulp (i.e., a prehydrolyzed pulp).

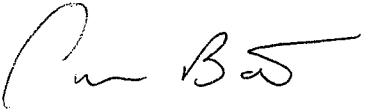
In view of the foregoing remarks it is respectfully submitted that the rejections under 35 U.S.C. § 103 have been overcome, and that the pending claims are in condition for immediate allowance.

Conclusion

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Appl. No.: 10/797,938
Amdt. dated 04/12/2007
Reply to Office action of 01/12/2007

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LEGAL02/30225518v1

ELECTRONICALLY FILED USING THE EFS-WEB ELECTRONIC FILING SYSTEM OF THE UNITED STATES PATENT & TRADEMARK OFFICE ON APRIL 12, 2007.

Second Edition

HANDBOOK
FOR
PULP & PAPER
TECHNOLOGISTS

Gary A. Smook

 ANGUS WILDE PUBLICATIONS

Vancouver  Bellingham

explained by the low accessibility of hydroxyl ions into the crystalline region of the cellulose. The acidic reaction products from the carbohydrates consume a major part of the alkali in the cooking liquor, as illustrated in Figure 7-8.

During delignification, there is also a corresponding reduction in pulp viscosity (a measure of cellulose weighted-average molecular weight). If pulp viscosity is allowed to fall below a critical level, the pulp strength drops dramatically. Maintenance of pulp viscosity is the principal reason that the kraft cook must be terminated at a point where a substantial level of residual lignin remains with the fibers. A derivation termed the G-factor (exactly analogous to the H-factor) can be applied for viscosity reduction, i.e., combinations of time and temperature that give the same G-factor can be expected to produce pulp with the same viscosity. Since the G-factor increases more rapidly with temperature than the H-factor, it follows that higher cooking temperatures have a proportionally greater effect on viscosity reduction. This is the principal reason why cooking temperatures above 180°C are avoided.

About 90% of the extractives in wood are removed during the extraction phase of the cook. Fatty and resin acids form sodium salts and are removed later

from the residual liquor as tall oil soap. Volatile turpentine is recovered from the vapor relief during steaming or cooking.

Prehydrolysis Stage for Dissolving Grades

Regular (papermaking) kraft pulp contains certain carbohydrates, principally pentosans, that interfere with the chemical conversion of cellulose into rayon and acetate products. As a consequence, the practice of exposing the wood chips to acid hydrolysis prior to alkaline cooking was developed in order to reduce the pentosan content and obtain a higher proportion of alpha cellulose.

The usual method of prehydrolysis is with direct steaming. The action of the steam liberates organic acids from the wood which, at elevated temperature, hydrolyze hemicelluloses to soluble sugars. The subsequent kraft cook then produces a pulp suitable for dissolving applications. Typically, the pulp yield from a prehydrolyzed cook is 5 to 7% lower on dry wood than from a regular kraft cook.

A representative cooking schedule for batch cooking of prehydrolyzed hardwood kraft pulp is shown in Figure 7-9. Total cooking cycle time is 8 hours, including 140 minutes at maximum hydrolysis temperature and 70 minutes at maximum kraft cooking temperature.

7.5 OPERATION AND CONTROL

The basic variables affecting the kraft cooking process are listed in Table 7-2. The objective is to cook consistently to a target lignin content (as measured by the kappa number or permanganate number test) with a minimum level of screen rejects.

As with most chemical pulping methods, sufficient time must be provided at a lower temperature to achieve good liquor penetration into the chips before

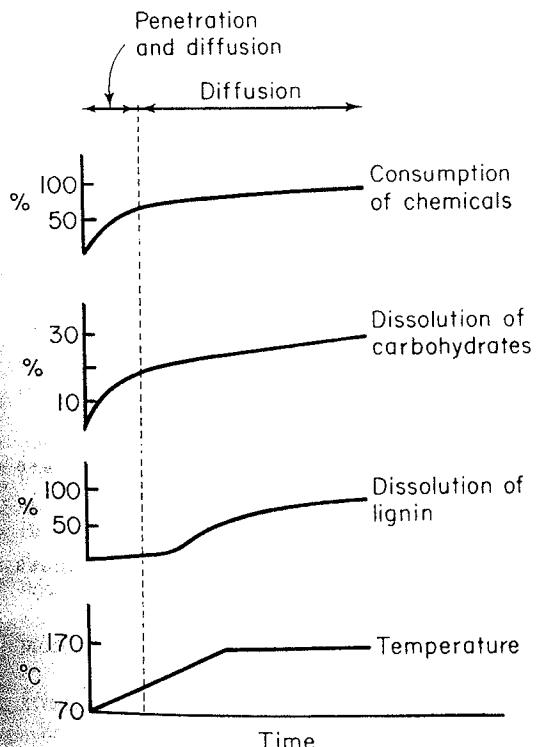


FIGURE 7-8. Consumption of chemicals, dissolution of carbohydrates, and dissolution of lignin as a function of time and temperature (Hartler).

TABLE 7-2. Variables affecting kraft cooking.

Wood Chips	<ul style="list-style-type: none"> • species • general chip quality (size distribution, freedom from contaminants, etc.) • moisture content
Cooking Liquor	<ul style="list-style-type: none"> • sulfidity
Cooking Control	<ul style="list-style-type: none"> • chemical application (AA or EA on o.d. wood) • liquor-to-wood ratio • temperature cycle • time/temperature curve (H factor)
Control Parameters	<ul style="list-style-type: none"> • degree of delignification (as indicated by permanganate or kappa number tests) • residual alkali